

REMARKS

In the last Office Action, the Examiner rejected claims 3 and 22 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,038,280 to Rossiger et al. ("Rossiger") in view of U.S. Patent No. 3,806,726 to Ishijima. Claims 1-2 and 5-21 were allowed by the Examiner. Claims 4 and 23-26 were objected to as being dependent upon a rejected base claim, but indicated to be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims.

Applicant and applicant's counsel note with appreciation the indication of allowable subject matter concerning claims 1, 2, 5-21 and 23-26. However, for the reasons noted below, applicant respectfully submits that amended claims 3 and 22 also patentably distinguish from the prior art of record.

In accordance with the present response, independent claims 3 and 22 have been amended to further clarify the "focusing" function of the second collimator block. More specifically, each of amended independent claims 3 and 22 requires a second collimator block for "focusing the primary x-rays toward the first collimator block." As further discussed below, the prior art of record does not disclose or suggest the structural combination of the first and second collimator blocks and corresponding "focusing" functions.

Applicant respectfully requests reconsideration of his application in light of the following discussion.

The present invention is directed to a fluorescent X-ray film thickness measuring device.

As described in the specification (pgs. 2-6), conventional fluorescent X-ray film thickness measuring devices have not been able to generate, without great difficulty and expense, a microscopic beam from primary X-rays for focusing onto microscopic measurement regions of a sample. As a result, the conventional devices have not been able to obtain measurements from a sample (e.g., thickness measurements) with high efficiency.

The present invention overcomes the drawbacks of the conventional art. In one embodiment according to the present invention shown in Figs. 1 and 6, the fluorescent X-ray film thickness measuring device has an X-ray generating system having a high-voltage power source 1 and an X-ray tube 2 for generating and emitting primary X-rays 3. A first collimator block 66 focuses the primary X-rays 3 onto microscopic measurement regions of a sample 5. A second collimator block 64 is disposed above the first collimator block 66 for receiving primary X-rays 3 from the X-ray generating system and focusing the primary X-rays 3 toward the first collimator block 66. A sample observation optical system 6 is provided

for observing the sample during focusing of the primary X-rays 3 for use in positioning of the microscopic measurement regions relative to the primary X-rays 3. A detector 13 detects X-ray fluorescence generated from the sample 5. Pre-amplifiers 10, 14 amplify a signal from the detector 13. Linear amplifiers 11, 15 amplify signals from the pre-amplifiers 10, 14. Frequency analyzers 12, 16 analyze a frequency of a signal from the linear amplifiers 11, 15.

By providing the first and second collimators, microscopic beams are efficiently generated from the X-rays and then accurately focused onto microscopic regions of the sample for obtaining measurement information.

Traversal of Prior Art Rejection

Claims 3 and 22 were rejected under 35 U.S.C. §103(a) as being unpatentable over Rossiger in view of Ishijima. Applicant respectfully traverses this rejection and submits that the combined teachings of Rossiger and Ishijima do not disclose or suggest the subject matter recited in amended independent claims 3 and 22.

Amended independent claim 3 is directed to a fluorescent X-ray film thickness measuring device and requires an X-ray generating system having a high-voltage power source and an X-ray tube for generating and emitting primary X-rays,

focusing means including a first collimator block for focusing the primary X-rays onto microscopic measurement regions in a sample and a second collimator block disposed above the first collimator block for receiving primary X-rays from the X-ray generating system and focusing the primary X-rays toward the first collimator block, a sample observation optical system for observing the sample during focusing of the primary X-rays for use in positioning of the microscopic measurement regions relative to the primary X-rays, a detector for detecting X-ray fluorescence generated from the sample, a pre-amplifier for amplifying a signal from the detector, a linear amplifier for amplifying a signal from the pre-amplifier, and a frequency analyzer for analyzing a frequency of a signal from the linear amplifier. No corresponding structural combination is disclosed or suggested by the prior art of record.

Amended independent claim 22 is also directed to a fluorescent X-ray film thickness measuring device and requires an X-ray generating system for generating and emitting primary X-rays, a first collimator block for focusing the primary X-rays onto microscopic measurement regions in a sample, a second collimator block disposed above the first collimator block for receiving primary X-rays from the X-ray generating system and focusing the primary X-rays toward the first collimator block, a sample observation optical system for

observing the sample during focusing of the primary X-rays for use in positioning of the microscopic measurement regions relative to the primary X-rays, a detector for detecting X-ray fluorescence generated from the sample, a pre-amplifier for amplifying a signal from the detector, a linear amplifier for amplifying a signal from the pre-amplifier, and a frequency analyzer for analyzing a frequency of a signal from the linear amplifier. Again, no corresponding structural combination is disclosed or suggested by the prior art of record.

The primary reference to Rossiger discloses an apparatus for measuring the thicknesses of thin layers by means of X-ray fluorescence (Fig. 1). The apparatus has an X-ray tube 2, a workpiece or sample 7, and a collimator disposed between the X-ray tube 2 and the sample 7 for focusing an X-ray 6 to produce a closely defined X-ray spot 13 on and in the sample 7 (col. 3, lines 25-29). Thus Rossiger discloses a single collimator for producing the closely defined X-ray spot or microscopic beam. In contrast, each of amended independent claims 3 and 22 requires two collimators. More specifically, each of amended independent claims 3 and 22 requires a first collimator block for focusing the primary X-rays onto microscopic measurement regions in a sample and a second collimator block disposed above the first collimator.

block for receiving primary X-rays from the X-ray generating system and focusing the primary X-rays toward the first collimator block.

The Examiner contends that the elements denoted with reference numerals 14 and 16 in Rossiger constitute a second collimator block as required by independent claims 3 and 22. Applicant respectfully disagrees with the Examiner's contention.

Applicant respectfully submits that the elements denoted by reference numerals 14 and 16 in Fig. 1 of Rossiger are a reflecting mirror 14 and an orifice 16 of the reflecting mirror 14 and, therefore, not a collimator. Stated otherwise, as is well known, a collimator is an optical apparatus which has an arrangement of slits or apertures which limit a stream of particles to a beam in which all the particles move in the same, or nearly in the same, direction. For example, collimators 64 and 66 are shown in Fig. 6 of the present application. The reflecting mirror 14 and corresponding orifice 16 clearly do not have the foregoing structure and function required by a collimator. The reflecting mirror 14 in Rossiger is disposed between the X-ray tube 2 and the collimator 12 and has the orifice 16 through which the X-ray 6 passes (col. 3, lines 30-32). The function of the reflecting mirror 14 and corresponding orifice 16 in Rossiger

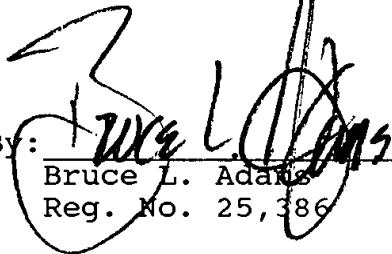
is to permit observation of an impact point 13 of the X-ray 6 on the sample 7 (col. 3, lines 32-34). In contrast, claims 3 and 22 require first and second collimators for providing a "focusing" function (i.e., for focusing the primary X-ray onto microscopic measurement regions in a sample). Accordingly, the reflecting mirror 14 with the orifice 16 in Rossiger differ in both structure and function from each of the collimators recited in amended independent claims 3 and 22.

The secondary reference to Ishijima has been cited by the Examiner for its disclosure of pre-amplifiers and linear amplifiers. However, Ishijima does not disclose or suggest the structural combination of the fluorescent X-ray film thickness measuring device recited in amended independent claims 3 and 22, including the first and second collimators and corresponding functions. Since Ishijima does not disclose or suggest these features, it does not cure the deficiencies of Rossiger. Accordingly, one of ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicant respectfully submits that the rejection of claims 3 and 22 under 35 U.S.C. §103(a) as being unpatentable over Rossiger and Ishijima be withdrawn.

In view of the foregoing amendments and discussion, the application is believed to be in allowable form. Accordingly, favorable reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,
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February 2, 2004

Date